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# PROGRESS THROUGH TEAMWORK

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It is an honor to provide the editorial comments for this first issue of the Aeronautics and Astronautics publication. I believe that the merger of the two organizations exemplifies a trend of progress that is very prominent in our fast-moving space age. A sound united front, advancing toward a common goal, has proven to be a very effective mode of operation. Teamwork was one of the basic premises on which our nation began and still operates. The progress of our space program during the past 4 years, the beginning of the space age, is well known. This has been strongly influenced by the exceptional cooperation of the Federal civilian-military-industry team who participated in the program.

## PROGRESS IN 1962

An excellent example of this progress was demonstrated in the past year, during which we have completed three successful manned orbital flights and have thus accomplished the original objectives of Project Mercury. However, we will soon attempt a more ambitious undertaking, that of a one-day manned mission in which a modified Mercury spacecraft will be used. This mission will provide an opportunity to examine further man's physiological responses to the factor of weightlessness and will provide experience concerning the adequacy and reliability of our basic Mercury systems during more prolonged periods in the space environment. Also during the past year, Project Gemini became an approved program. This project is the necessary step that bridges the "relatively simple" Mercury missions with the highly complex Apollo lunar program. Project Gemini will afford an opportunity to explore the problems associated with more prolonged weightlessness and to gain the necessary experience in new techniques such as rendezvous and docking. Without the benefits gained from this program the technological jump would be difficult if not impossible. In addition, the Gemini spacecraft, being a second-generation manned spacecraft, has the initial capability for exploring other mission potentials, such as extravehicular operation, resupply and crew transfer, a taxi vehicle to ferry personnel to orbiting space stations, approach and inspection of objects orbiting in space, and maintenance and crew-rescue vehicles.

Project Apollo has passed some significant milestones during this period. Management concepts have been evolved and National Aeronautics and Space Administration has built up an organization to implement the many facets of the program. The NASA Office of Manned Space Flight in ~~NASA Headquarters~~ Washington is responsible for planning and controlling the total program and for integrating the various phases of the effort. The Marshall Space Flight Center has the responsibility for the launch vehicle and for managing both the Michoud assembly plant and the Mississippi Test Facility. The Launch Operations Center at Cape Canaveral is responsible for providing the facilities at the Cape and for the launch of the vehicle. The Manned Spacecraft Center provides the manned spacecraft, and the mission-planning and flight-control aspects of the program. During the past year, prime contracts have been awarded for the various elements of the spacecraft; also, decisions have been made and are being implemented with respect to use of the three-stage Saturn C-5 as the launch vehicle, the use and expansion of the Cape Canaveral area as the launch site, and the use of the lunar-orbit rendezvous as the mode of operation for lunar landings. Major emphasis is presently being placed on the design, development, and construction of these vehicles and facilities.

## FUTURE PROGRESS

The NASA utilizes all of its Centers directly or indirectly in working toward the ultimate goals of space flight. The various Centers must make such contributions as: information from unmanned programs to further our knowledge of the moon, planets, and the space environment; the development of launch vehicles capable of placing a manned spacecraft on the moon and providing a ferry service to an orbiting space station or conducting manned interplanetary missions; and providing a communications and data computation service for a worldwide network. The NASA Centers also aid in providing research and studies in areas of chemical, electrical, and nuclear propulsion systems; orbital rendezvous; lunar landing; flight control; navigation and guidance problems; entry and environmental physics; and space biology. However, the efforts of the NASA are only part of the overall resources necessary for achieving the goals of the manned space flight program.

We must also rely on other organizations for flight hardware, test facilities, and other general areas of support. The Department of Defense, the Weather Bureau, the Atomic Energy Commission, and other federal agencies have directly supported the program. A prime example of this support is the contribution that various agencies made to the success of the Mercury program. The Air Force provided the launch vehicles and acted as our representative to the launch-vehicle contractors. This same procedure still exists for Project Gemini, a program that will use three different propulsion vehicles. The Department of Defense provided medical monitoring support during the missions and analyzed the data obtained, conducted experiments in the training of the astronauts, and provided the recovery forces. There are still other contributions too numerous to mention; but without this cooperation, Mercury could not have been implemented, and the other manned space programs would not have advanced as far as they have.

Industry provides another area of direct support, and the amount of this support is as large and varied as the number of contractors contributing. In addition to the prime contracts and subcontracts that are let for furnishing the space vehicle hardware and supporting equipment, there are many minor contracts let to universities and smaller companies for services, associated equipment, studies, and testing.

## PROGRAM PHILOSOPHY

It has taken a common effort such as that just briefly explained to make a program like Mercury a success. For the more extensive programs of the future this effort must be amplified considerably. I am not only speaking in terms of the number of people or the cost, although there will probably be a large increase in these two catagories for a few years before the trend begins to stabilize. I am more concerned with the general attitude toward manned space flight. There will be massive research, engineering, and development efforts necessary for advanced programs such as the design and development of vehicles capable of interplanetary travel. Knowledge of the universe can only be obtained by using space vehicles of considerably increased capability. The design and development of advanced systems will aid in achieving this increased capability, but probably an equally important and influencing factor is the talent to employ intelligent and decisive methods of keeping pace with the momentum of our technology. Aggressive planning and thinking are imperative to take full advantage of the creation, research, and development that will effect our overall plan. Industry and government agencies must take the initiative in their respective fields to push the technical state-of-the-art to the limits. Although we can see over the horizon toward subsequent programs (and we must possess the capability to look far ahead), we must approach these programs through logical steps.

It is from these logical steps that we obtain information upon which to base our decisions for future programs. Each step has its own milestones that must be traversed in order to contribute toward man's far-reaching goals in space.

However, full recognition of the reliability and quality control requirements must be ever present in the advancement of the technology. The first consideration is simplicity of design and the budgeting of element reliabilities from an overall numerical value. The responsibility must rest on the spacecraft designer who budgets to the subsystems the requirements on the degree of redundancy and other measures for improving reliability. Second, the confidence of randomly selecting samples for qualification purposes cannot be justified unless all supposedly identical parts from the assembly are truly identical in all essential features. To achieve a degree of control, all components requiring certification through qualification should be made up from sets of parts whose members have been produced consecutively on the same assembly line without an intervening change in design, process, or materials. Third, a strict control on the identification and use of parts is necessary to insure that all suspected parts can be readily located, should a need arise to remove and replace parts that have revealed a deficiency. In the area of inspection, flight-safety considerations and the limited number of articles involved in our programs make it reasonable to require 100-percent inspection of all items. This selection process should contribute to the insurance of locating and rejecting defective and marginal items. When an equipment malfunction does occur, failure analysis and decisions for corrective action must take place immediately. This can often best be done at the scene of the failure, where the availability of the part, the test apparatus, and the people involved

in the test offer the best opportunity for accurate determination of the pertinent facts. The last and most fundamental requirement is the personnel involved. Each employee of each contributing group has to possess the degree of pride in his workmanship necessary to prevent any compromise in the quality of his work. Accomplishing true reliability will require people who will never overlook or ignore, but rather who will recognize, the slightest sign of trouble - people who will freely give the last bit of extra effort that so often spells the difference between success and failure.

The progress that will be achieved in space will be the result of a large team rising to the most challenging assignment ever given to the American scientific, engineering, and industrial community. It is the duty of every person involved in this vital national program to cooperate in a united effort to achieve our goals in space flight.